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Transgenic Virus-Resistant Plants and New Plant Viruses: Workshop Highlights

The U.S. Department of Agriculture's Animal and Plant Health Inspection Service and the American Institute of Biological Sciences convened a workshop on April 20-21, 1995, to address risk issues associated with the possible generation of new plant viruses in transgenic plants expressing viral genes that confer virus resistance. The workshop did not address issues associated with gene flow between crops and wild species and possible effects on wild plant populations. The following are highlights from the workshop's summary.

Recombination between Plant RNA Viruses.

There is no evidence to support the notion that frequent recombination events occur between viral taxa (e.g., between tobamoviruses and potyviruses) resulting in viable virus from growing season to growing season. However, limited evidence does suggest that in an evolutionary time frame, recombination events between viral taxa have resulted in the generation of new plant viruses. In addition, a growing body of evidence indicates that recombination between viruses in the same taxon (e.g., cucumber mosaic virus and peanut stunt virus) may be common. The significance of recombination between viruses in the same taxonomic group is unclear at this time.

Recombination between Plant RNA Viruses and Viral Transgenes.

Comparing rates of recombination between two viruses in an infected plant with rates of recombination between a virus and a viral gene being expressed in a transgenic plant must be made with caution. Although certain assumptions can be made, scientists are just now starting to understand the frequency and importance of these types of recombination events. Experiments were proposed to study recombination under varying degrees of selection pressure.

Transcapsidation and Synergism.

Genomic. Genomic viral RNA transcapsidated with coat protein produced by a transgenic plant should not have long-term effects, since the genome of the infecting virus is not modified. Similarly, synergistic interactions between an infecting virus and a viral transgene should not have long-term impacts on the agricultural production. However, these potential interactions are important and should be tested before a new cultivar is marketed.

Benefits and Monitoring. The potential benefits of transgenic virus resistance include increased yield, reduced pesticide use to control vectors, improved crop quality, and increased potential for multiple virus resistance traits. Regular monitoring of all transgenic plants for the production of new plant viruses is not feasible. Any new virus problem that might result from the use of transgenic plants would be detected by farmers, seed producers, and scientists, as would any new plant virus or virus disease.

Conclusion. Virologists are beginning to understand the mechanisms underlying transgenic virus resistance and recombination. More research is needed to explain these mechanisms and to assess the environmental and agricultural risks that might be presented by the commercialization of transgenic virus-resistant crops. Most workshop participants believe that current data obtained from laboratory and field research indicate the risk associated with the generation of new plant viruses through recombination should not be a limiting factor to large-scale field tests or commercialization of transgenic plants expressing viral transgenes. However, some workshop participants believe that commercialization should be delayed until more experimental data are available to assess risks. Some workshop participants expressed concern over the commercial use of wild-type movement protein genes in transgenic plants. With or without the use of transgenic plants, new

plant virus diseases will develop that will require attention. No technology is risk free; a determination will need to be made whether the benefits associated with the use of transgenic virus resistance are greater than the risks.